

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FORAGE HARVEST MANAGEMENT

(Acre)
CODE 511

DEFINITION

The timely cutting and removal of forages from the field as hay, green-chop, or ensilage.

PURPOSES

This practice may be applied as a part of a conservation management system to support one or more of the following:

- Optimize the economic yield of forage at the desired quality and quantity
- Promote vigorous plant regrowth
- Maintain life of stand for the desired time period
- Maintain desired species composition of the stand
- Use forage plant biomass as a tool for nutrient uptake
- Control insects, diseases and weeds
- Maintain and/or improve wildlife habitat

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where machine harvested forage crops are grown.

CRITERIA

General Criteria Applicable to All Purposes

Forage will be harvested at a frequency and height that will maintain a desired healthy plant community through its life expectancy.

a. Stage of Maturity

Harvest forage at the stage of maturity that provides the desired quality and quantity

forage for the livestock being fed. Early cutting produces higher quality but lower quantities. Delayed harvests will usually increase yield but lower quality. This lower quality forage is still appropriate for some classes of livestock. Digestibility drops at a rate of approximately 0.5 percent per day for each day delay in harvest beyond the early flowering stage. A forage test is the most reliable method to determine forage quality and insure that livestock nutrient needs are met.

Delay harvest if prolonged or heavy precipitation is forecast that would seriously damage cut forage or cause soil compaction or ruts.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

b. Moisture Content

Harvest silage/haylage crops at the ideal moisture range for the type of storage structure(s) being utilized. (see Table 2)

Treat direct cut hay crop silage (moisture content > 70%) with chemical preservatives or add dry feed stuffs to avoid fermentation and digestible dry matter losses from seepage.

For optimal forage quality, rake, ted, or invert swaths, and bale when hay has sufficient moisture to prevent leaf loss.

Bale at optimum moisture levels to preserve forage quality and quantity. Approximate percent moisture should be as follows:

- Bale field- cured hay at 15 to 20 percent moisture.
- Bale forced- air- dried hay at 20 to 35 percent moisture.
- Rake hay at 30 to 40 percent moisture.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version, visit the Missouri NRCS web site.

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- Ted or invert swaths when moisture is above 40 percent.

c. Length of cut

When harvested for ensilage forage will be chopped to a size that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process. The length of cut range for hay-crop, corn, sorghum, and small grain silages is 3/8 to 3/4 inch with about 20 percent longer than 1 inch to aid in rumen digestion.

d. Contaminants

Forage shall not contain contaminants at levels injurious to the health of the livestock class and type being fed.

Contaminants are any objectionable matter or toxin that can cause illness, death, or rejection of the offered forage. For more information on contaminants and toxins see National Range and Pasture Handbook -5.2-57,58.

Additional Criteria to Improve or Maintain Stand Life, Plant Vigor, and Forage Species Mix

a. Stage of Maturity and Harvest Interval

Cut forage plants at a stage of maturity or harvest interval range that will provide adequate food reserves and/or basal or auxiliary tillers or buds for regrowth and/or reproduction to occur without loss of plant vigor (see Table 1). Harvesting early will improve quality but may reduce stand life if done continually. Harvesting a little later lowers quality, but increases yield, builds food reserves, allows basal buds to break dormancy, and increases stand life. More frequent harvests tend to decrease overall yield, reduce plant vigor, and lead to a progressive stand decline.

When grasses and legumes are grown together, the legume stage of maturity is used to time the harvest except in the case of birdsfoot trefoil, Ladino clover, and white clover. These two clovers and birdsfoot trefoil tend to maintain their quality because they are indeterminate in their growth habit.

Cut reseeding annuals at a stage of maturity and frequency that ensures the production of

viable seed or ample carryover of hard seed to maintain desired stand density.

If plants show signs of short-term environmental stress, management will be applied in a manner that ensures continued health and vigor of stand.

b. Stubble Height

Cut forage plants at a height that will promote the vigor and health of the desired species. Cutting heights will provide adequate residual leaf area; adequate numbers of terminal, basal, or auxiliary tillers or buds; insulation from extreme heat or cold; and/or unsevered stem bases that store food reserves needed for full, vigorous recovery (see Table 1).

Manipulate timing and cutting heights of harvest to ensure germination and establishment of reseeding or seeded annuals.

c. End of season harvest and regrowth interval

The end of the growing season harvest interval should be at least 40 days for legumes and 30 days for grasses before a killing frost. This allows food reserves to replenish before going into winter. After a killing frost excess regrowth may be pastured or harvested if needed. Leaving unharvested regrowth may increase forage stand survival significantly depending on the severity of the winter and the vigor of the stand going into the winter. The regrowth can be left to provide soil insulation and cover for wildlife. The added insulation can reduce the chances of frost heave damage as well as winter killing.

d. Soil Fertility

Adequate amounts of lime, nitrogen, phosphate, potash and certain minor elements are needed for yield, quality and to maintain stand life. Harvested forage removes large amounts of nutrients per acre. A soil test should be used as a guide in determining the amount of fertilizer and lime needed for sustainable hay production. Care should be taken to insure nutrients are returned back on these lands in nearly the same proportion and amount as were removed.

Additional Criteria to Use as a Nutrient Uptake Tool

Employ a harvest regime that utilizes the maximum amount of available or targeted nutrients. For specific nutrient uptake, select forage species that can maximize uptake. For further guidance see Waste Utilization (633).

Additional Criteria to Control Disease, Insect, and Weed Infestations

If foliar diseases, insects, or weeds threaten stand survival or production objective, schedule harvest periods as needed to control disease, insect, and weed infestations.

Lessen incidence of disease, insect damage, and weed infestation by managing for desirable plant vigor. Prescribed burning may be used as a tool for weed control and to stimulate plant vigor. See Prescribed Burning (338).

Additional Criteria to Improve Wildlife Habitat Values

Maintain appropriate harvest schedule(s), cover patterns, and plant height to provide suitable habitat for the desired specie(s).

July or August harvest schedules will enhance the success of ground nesting wildlife. Unharvested field edges, corners or odd areas provide habitat for ground nesting wildlife within fields that are harvested in spring or early summer.

Field edges, corners or odd areas left unharvested throughout the growing season can provide critical brood rearing habitat for a variety of wildlife.

CONSIDERATIONS

When pastures produce forage in excess of livestock demand during high growth rate periods, consider preserving forage quality by machine harvesting a portion of the standing crop. Coordinate this practice with Prescribed Grazing (528).

Well-fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. Coordinate this practice with Nutrient Management (590).

Reseeding or interseeding may be necessary re-establish, maintain or improve the stand. Select cultivars that are suitable for the harvest

regime, species mix, and forage quality desired. See Pasture and Hay Planting (512).

When insect and disease outbreaks exceed economic thresholds and are uncontrollable by harvest management, pesticide applications may be needed. Another option is to select a resistant cultivar when the stand is replaced. See Pest Management (595).

To control forage plant diseases, insects, and weeds, clean harvesting equipment after harvest and before storing. Do not cut forages until dew, rain, or irrigation water on leaves has evaporated.

When weed infestation exceeds the economic threshold and is uncontrollable by forage harvest management alone, weed management should be planned and applied.

Take care not to produce stored forages whose quality is not that needed for optimum performance of the animal being fed. For instance, immature legume forages can be too low in fiber and lead to metabolic disorders in ruminants and an economic loss to the producer due to lowered animal performance.

Direct cut grass and legume silage can create silage leachate (seepage). Consider the collection, storage, and disposal of this leachate as part of an agricultural waste management system.

In conjunction with harvest options, explore storage and feeding options that will retain acceptable forage quality and minimize digestible dry matter loss.

In regions where rainfall and/or humidity levels cause unacceptable forage quality losses in at least one harvest during the year, consider ensiling the forage to reduce or eliminate field drying time. Other options are: the use of desiccants, preservatives, conditioners, macerating implements, greenchopping, grazing or barn curing techniques to reduce field drying time. These techniques can improve the timeliness of harvest and preserve forage quality.

To reduce safety hazard, avoid operating harvesting and hauling equipment on field slopes over 20 percent, particularly on cross slope traffic patterns. Extreme caution should be exercised when ejecting large round bales on steeper slopes as bales can roll and cause damage to structures and equipment and/or physical injury.

PLANS AND SPECIFICATIONS

Place the detailed specifications for the specific forage crop and site in a site specific job or design sheet, or in the practice narrative in the conservation plan.

These plans and specifications shall be consistent with this standard and shall describe the requirement for applying the practice to achieve its intended purpose. For further guidance and crop specific specifications see Table 1.

OPERATION AND MAINTENANCE

Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock, could lead to sickness (for example, hardware disease) or death.

Monitor weather conditions and take action accordingly before and after cutting to optimize forage wilting or curing time to preserve feed quality and prevent forage swaths or windrows from smothering underlying plants.

Inspect and repair harvesting equipment following manufacturer's preventative maintenance procedures.

All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working on or unplugging moving parts.

Select equipment sizes and capacities that will, in a timely and economically feasible manner, handle the acreage normally harvested.

Operate all forage harvesting equipment at the optimum settings and speeds to minimize loss of leaves.

Set shear-plate on forage chopper to the proper cut for the crop being harvested. Keep knives well sharpened. Do not use recutters or screens unless forage moisture levels fall

below recommended levels for optimum chopping action.

Regardless of silage/haylage storage method, ensure good compaction and an air-tight seal to exclude oxygen and mold formation.

REFERENCES

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TABLE 1
FORAGE HARVEST GUIDE

Forage Species¹	Optimum Stage to Harvest²	Approximate Date³	Stubble Height⁴
Alfalfa	Bud stage for 1st cutting; 1/10 bloom for second and subsequent cuttings	Early to mid May	3"
Tall Fescue, Orchardgrass and Timothy	Boot to early bloom for 1st cut; after 8" of new regrowth fo subsequent cuttings	Mid May	3"
Red and Arrowleaf clovers 3"	1/4 to 1/2 bloom for 1st cutting; 1/4 bloom for subsequent cuttings	Mid May	
Crimson clovers	Early bloom	Late April to mid May	3"
Annual lespedeza	Early bloom	Late July through August	3"
Sericea lespedeza	When 12 - 15" tall	Mid June through August	4"
Birdsfoot trefoil and white clovers	1/4 bloom or at correct stage for companion grasses	Mid May	3"
Crownvetch	1/2 bloom	Mid May	4"
Reed Canarygrass and Bromegrass	Early to mid bloom for 1st cutting; after 8" of new regrowth or when new basal buds appear at the soil surface for subsequent cuttings	Mid to late May	3-4"
Bermudagrass	10 to 18" tall, prior to seedhead formation or lower leaves starting to brown; subsequent cuttings at 4 to 5 week intervals	June through August	2-3"
Old World Bluestems 3"	At or prior to boot, normally 15 to 20" tall	Early June through August	

Subsequent cuttings every 4 to 6 weeks

Forage Species ¹	Optimum Stage to Harvest ²	Approximate Date ³	Stubble Height ⁴
Big Bluestem*	At boot, 24 to 30" tall	Early to mid July	4-6"
Indiangrass*	Prior to boot, 18 to 30" tall	July to early August	4-6"
Switchgrass*	At boot, 30 to 45" tall	Early June to late July	6"
Native Prairie	At boot, one cutting <u>only</u>	Late June to mid July	5"
Eastern Gamagrass	Prior to boot for 1st cutting; subsequent cuttings at 30 to 45 day intervals	Mid May to early August	6-8"
Summer Annuals - Sudangrass, sorghum- sudan hybrids, pearl millet	At 24 to 36" tall; subsequent cuttings when regrowth reaches 24" tall	Mid June through September	6-10"
Crabgrass	Boot to early head for 1st cutting; subsequent cuttings at 4 to 5 week intervals	Mid June through September	2-3"
Winter Annuals - wheat, barley, rye, triticale	Boot to early dough	May 10 to June 1	2"
Spring Annuals - oats, ryegrass	Boot to early dough	Mid May through August	2"
Soybeans	Mid to full bloom - before bottom leaves begin to fall	July 15 through September 15	2"
Corn - for silage	Fully dented and kernels begin to glaze	August 15 to first frost	3"

* One to two cuttings per year. Don't harvest after August 10.

¹ Common forage species used for mechanical harvest

² Times suggested generally provide the optimum time to harvest for higher quality. Later harvests usually yield more forage of a lower quality.

³ Approximate time of year when forage will reach optimum harvest stage.

⁴ Minimum cutting or stubble height adequate to insure plant vigor and health

TABLE 2
SILAGE STORAGE STRUCTURE FORAGE MOISTURE SUITABILITY

Storage Structure Type	Hay - cropⁱ (% moisture)	Corn Silageⁱ (% Moisture)
Upright or tower, conventional	60 - 65	63 - 68
Upright or tower, oxygen - limiting	40 - 55	55 - 60
Bunker or horizontal	65 - 70	65 - 70
Bag silo (plastic tube)	50 - 60	65 - 70
Balage (plastic wrapped round bales)	50 - 60	-----

¹ Bermudagrass should be ensiled direct cut (65 to 70%) to get required packing.

² Add 5 percent to the range for sorghum silage.